

City of Alexandria, Virginia

# Combined Sewer System Permit and Long-Term Control Plan Update

VDEQ Progress Briefing  
February 19, 2016

Department of Transportation and Environmental  
Services



**Eco-CITY**  **ALEXANDRIA**

# City of Alexandria, Virginia

## AGENDA

- ☐ Public Participation and CSS Stakeholder Group
- ☐ Site/Alignment
- ☐ Sizing Sensitivity
- ☐ GI Strategy Update
- ☐ Spending Projections



# Long Term Control Plan Update Overall Strategy



Other  
Potential  
Opportunities

Targeted Sewer  
Separation  
Complementary Strategy

Green Infrastructure  
Complementary Strategy

Store and Treat  
Primary Strategy

# Short List of Strategies for Further Evaluation

## Primary Strategies

(will select one for final plan)

1. Separate storage tunnels (CSO 003/004 tunnel and CSO 002 tunnel)
2. Storage tunnel for Hooffs Run (CSO 003/004) and storage tank at Royal Street (CSO 002)
3. One storage tunnel for CSOs 002 (Royal Street), 003 and 004 (Hooffs Run)

## Complementary Strategies

1. Green Infrastructure
2. Area Reduction Plan (Targeted Sewer Separation)
3. Other opportunities to be considered
  - Downspout disconnection
  - Low flow-fixture rebates

City of Alexandria, Virginia

# Public Participation and CSS Stakeholder Group



# CSS Stakeholder Group Charge

- \* Provide staff of T&ES, OMB, Office of Historic Alexandria, Recreation, Parks and Cultural Activities, and AlexRenew with recommendations on how a primary CSS control strategy can accomplish the City's environmental goals and permit requirements while minimizing impacts to the community
- \* Review and monitor the preparation of the LTCPU, including ongoing permit and other regulatory issues, engineering, and analysis of potential location of future CSS infrastructure facilities , and consideration of an implementation plan schedule and funding strategy
- \* Serve as a central information-receiving/dissemination body related to the City's LTCPU;
- \* Receive input from the public during development of the LTCPU.

# Public Participation Goals

- \* **Inform.** Increase stakeholder awareness of the City's combined sewer system and the Long Term Control Plan Update program.
- \* **Educate.** Develop basic understanding of the Long Term Control Plan Update recommended strategies.
- \* **Be Responsive.** Awareness, consideration and responsiveness on the Long Term Control Plan.
- \* **Seek Input.** Solicit feedback on the combined sewer control strategy recommendations.

# Outreach to Date

Date	Audience	Date	Audience
8/5/2013	Public Meeting (through EPC)	2/5/2015	LTCPU Phase I Public Meeting
10/30/2013	Federation of Civic Associations	2/11/2015	Old Town Civic Association
11/13/2013	Old Town Civic Association	3/18/2015	NorthEast Citizens' Association
11/14/2013	West Old Town Citizens Association	5/18/2015	Environmental Policy Commission
1/28/2014	City Council Work Session	5/19/2015	Waterfront Commission
5/19/2014	Environmental Policy Commission	5/26/2015	City Council Work Session
9/18/2014	Porto Vecchio	6/11/2015	West Old Town Citizens Association
10/21/2014	AlexRenew Board	6/18/2015	LTCPU Phase II Public Meeting
10/27/2014	Agenda Alexandria	10/7/2015	CSS Stakeholder Meeting #1
1/27/2015	City Council Legislative Session	11/2/2015	CSS Stakeholder Meeting #2
1/28/2015	Federation of Civic Associations	1/7/2016	CSS Stakeholder Meeting #3
2/2/2015	Environmental Policy Commission	2/4/2016	CSS Stakeholder Meeting #4

# Upcoming Outreach

## \* February 2016

- AlexRenew Board Meeting

## \* March 2016

- CSS Stakeholder Meeting #5
- Federation of Civic Associations

## \* April 2016

- CSS Stakeholder Meeting #6
- Public Meeting
- Old Town Civic Association
- West Old Town Citizens Association
- Waterfront Commission
- NOTICE Board Meeting
- Environmental Policy Commission
- City Council Worksession

## \* May 2016

- City Council Public Hearing

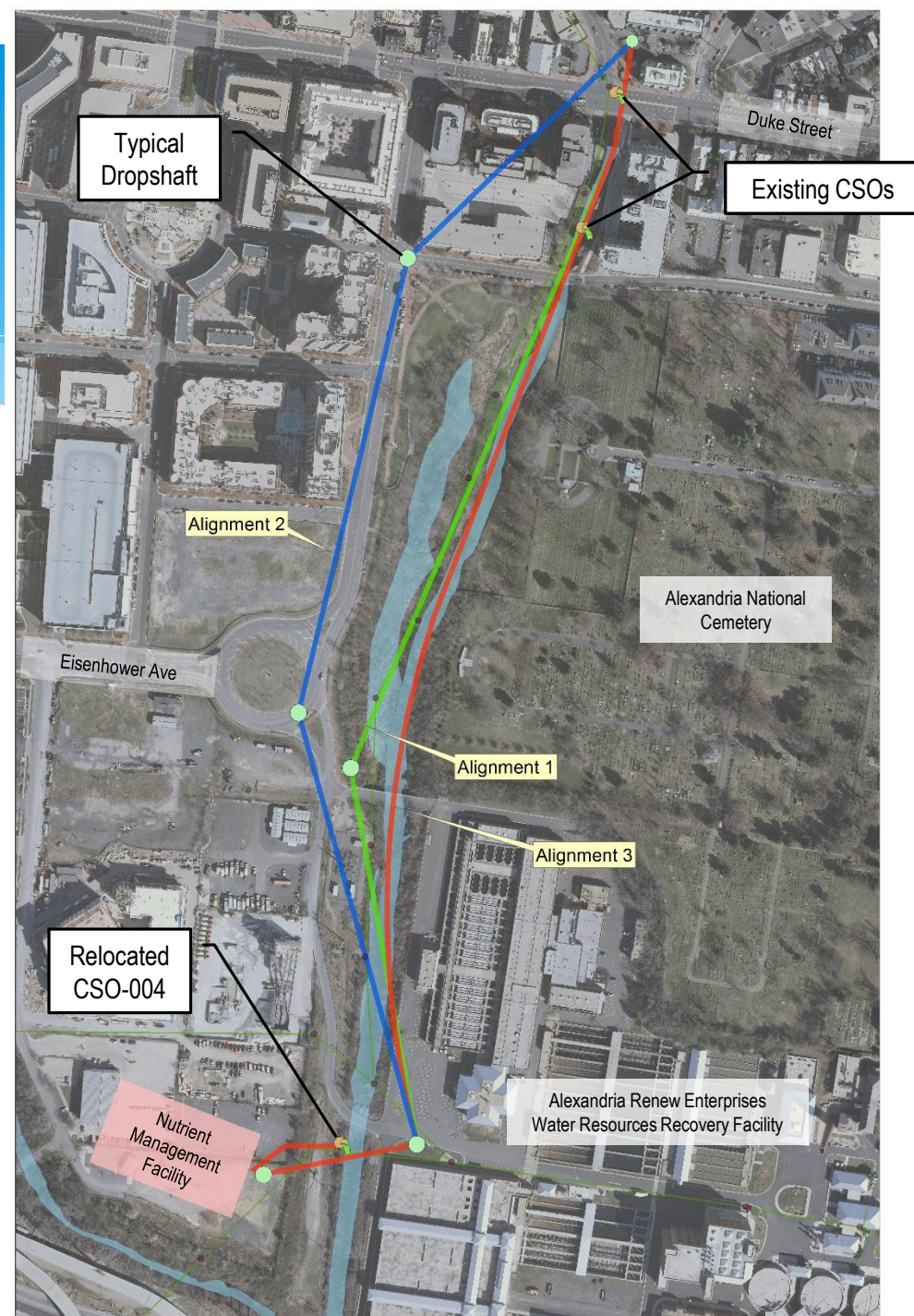
City of Alexandria, Virginia

# Site/Alignment



# CSO-003/004 Tunnel Alignments

- \* Alignments work for all diameters under consideration
- \* All alignments eliminate the HRJC
- \* Shafts range in diameter from 20-ft to 30-ft
- \* Shafts range in depth from 60-ft to 100-ft
- \* Working with AlexRenew to integrate the proposed wet weather infrastructure and this LTCPU infrastructure



# CSO-003/004 Alignments

	Advantages	Disadvantages
Alignment 1	<ul style="list-style-type: none"><li>• Avoids all buildings</li><li>• Avoids cemetery</li></ul>	<ul style="list-style-type: none"><li>• Dropshaft located in African American Heritage Park</li><li>• Dropshaft construction area located near Commonwealth Interceptor, Hooffs Run, and 230kV electric lines</li></ul>
Alignment 2	<ul style="list-style-type: none"><li>• Avoids African American Heritage Park and Hooffs Run</li></ul>	<ul style="list-style-type: none"><li>• Passes underneath several buildings</li><li>• Passes underneath Dominion substation</li></ul>
Alignment 3	<ul style="list-style-type: none"><li>• Avoids all buildings and African American Heritage Park</li><li>• Eliminates 1 dropshaft</li></ul>	<ul style="list-style-type: none"><li>• Entirely under Hooffs Run and AlexRenew site</li></ul>

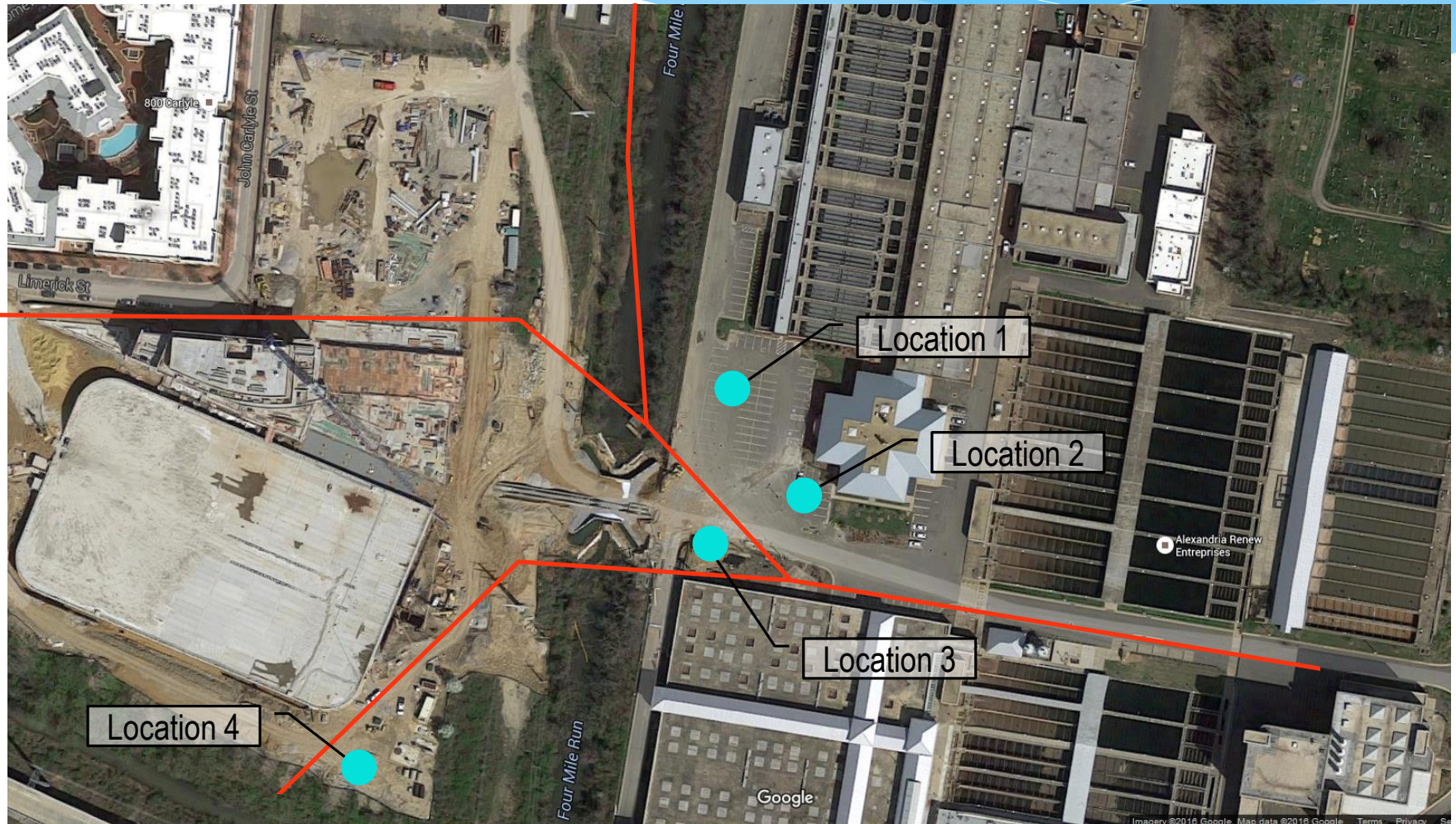
# Potential Upstream Dropshaft Location



# Potential Upstream Dropshaft Location

	Advantages	Disadvantages
Location 1	<ul style="list-style-type: none"> <li>• Within City right-of-way</li> <li>• No closure of Duke St</li> </ul>	<ul style="list-style-type: none"> <li>• Directly on top of Hooffs Run</li> <li>• Requires a major stream relocation</li> <li>• Closure of Dangerfield Road</li> </ul>
Location 2	<ul style="list-style-type: none"> <li>• Within City right-of-way</li> <li>• Minimizes piping needed for diversion structures</li> </ul>	<ul style="list-style-type: none"> <li>• Must close Duke Street for the duration of construction (approximately 3 years) and maintenance/cleaning</li> </ul>
Location 3	<ul style="list-style-type: none"> <li>• Within City right-of-way</li> <li>• No closure of Duke St</li> </ul>	<ul style="list-style-type: none"> <li>• Closure of Peyton Street</li> <li>• Requires a shaft at one of the other 3 locations</li> <li>• Adds cost and complexity</li> </ul>
Location 4	<ul style="list-style-type: none"> <li>• No closure of Duke St</li> <li>• Parking lot can be restored following construction (potential loss of parking spaces)</li> </ul>	<ul style="list-style-type: none"> <li>• Constructed on private property</li> <li>• Entire parking lot used for construction and laydown area</li> <li>• Access required for maintenance/cleaning</li> </ul>

# AlexRenew Shaft Location



# AlexRenew Shaft Location

- \* Must intercept flow downstream of HRJC
- \* Parking lot provides open area for construction and few underground utilities
- \* Location 1
  - Limits expansion of plant processes
- \* Location 2
  - Limits expansion of admin/lab building
- \* Location 3
  - No plant utility conflicts
- \* Location 4
  - Minimal work on East side of plant

# CSO-002 Tunnel Alignments (Joint Tunnel Option)



# CSO-002 Joint Tunnel Alignments

	Advantages	Disadvantages
Alignment 1	<ul style="list-style-type: none"><li>• Shortest alignment</li><li>• Underneath AlexRenew WRRF and City property</li></ul>	<ul style="list-style-type: none"><li>• Passes underneath buildings at the AlexRenew WRRF</li></ul>
Alignment 2	<ul style="list-style-type: none"><li>• Minimizes impact to residential neighborhood</li></ul>	<ul style="list-style-type: none"><li>• Entirely in VDOT right-of-way and private cemeteries</li><li>• Major utility conflicts at the AlexRenew WRRF</li></ul>
Alignment 3	<ul style="list-style-type: none"><li>• Much of alignment in City right-of-way</li></ul>	<ul style="list-style-type: none"><li>• Passes under 4 different cemeteries</li><li>• Requires significant infrastructure to be built on Royal Street to convey CSO flows back to the north</li></ul>

## CSO-002 Storage Tanks Alternatives



# CSO-002 Storage Tank Alternatives

	Advantages	Disadvantages
Alternative 1	<ul style="list-style-type: none"><li>• Opportunities to clean up Hunting Creek embayment</li></ul>	<ul style="list-style-type: none"><li>• On private property</li><li>• Potential permitting issues in Resource Protection Area (RPA)</li></ul>
Alternative 2	<ul style="list-style-type: none"><li>• In City right-of-way</li></ul>	<ul style="list-style-type: none"><li>• Disrupts access to Jones Point Park during construction and maintenance activities</li></ul>
Alternative 3	<ul style="list-style-type: none"><li>• Reclaim part of embayment</li><li>• Opportunities to clean up embayment</li><li>• Increase public access to waterfront</li></ul>	<ul style="list-style-type: none"><li>• Potential permitting issues</li><li>• Potential ownership/easement issues (still being researched)</li></ul>
Alternative 4	<ul style="list-style-type: none"><li>• Likely the least costly alternative, quickest construction</li></ul>	<ul style="list-style-type: none"><li>• National Park Service staff currently does not support this alternative</li></ul>

# Preliminary Engineer's Recommendation

## \* CSO-003/004

- Tunnel Alignment #1 – Keep available
- Tunnel Alignment #2 – Eliminate
- Tunnel Alignment #3 – Preferred, select as basis of planning

## \* CSO-002

- Storage tank is preferred over tunnels
  - More cost effective
  - Construction at 1 location, less impact on Old Town residents
  - Provides opportunities to improve the embayment
- Keep storage tank site location options open in Long Term Control Plan Update
- Prior to design and construction of infrastructure for CSO-002, the strategy for CSO-002 may be re-evaluated

- \* Above recommendations were generally supported by the CSS Stakeholder Group

City of Alexandria, Virginia

# Sizing Sensitivity Evaluation



# Scope of Evaluation

- \* Independent of Alignment Study
- \* Impacts on Overflows
  - # of Overflows
  - Volume
  - % Reduction
  - % Capture
  - NPW
- \* Beach Advisory Criterion
  - 235 cfu/100mL
- \* Tunnel Sizes
  - 8-ft diameter
  - 10-ft diameter
  - 12-ft diameter
- \* Tank Sizes
  - 2 million gallons
  - 3 million gallons
  - 4 million gallons

# 1984 vs 2004-2013

## 1984

- \* Rainfall = 37.1"
- \* Wet Weather Events = 72
- \* Largest Event:
  - 2.53"
  - 33 hours
  - 1-year storm event

## 2004-2013

- \* Annual rainfall = 40.6" on average
- \* Wet Weather Events = 73 on average per year
- \* Largest Event:
  - 9.55"
  - 49 hours
  - 130-year storm event

# CCO-003/004 Tunnel

## CSO-003/004 Tunnel Diameter Summary (1984)

Tunnel Diameter	Tunnel Volume (MG)	Number of Overflows	Volume of Overflows (MG)	Overflow Reduction (%)	Flow Capture (%)	NPW (\$M)
Current Conditions (no tunnel)	-	67	29.1	-	75%	-
8-ft	1.0	5	2.9	90%	98%	\$69-\$103
10-ft	1.6	3	1.1	96%	99%	\$77-\$115
12-ft	2.3	0	0	100%	100%	\$85-\$127

**Note:** Expected performance estimated for the Typical Year (1984). Actual overflows and volume will be more or less based on specific rainfall events each year.

# CSO-003/004 Tunnel Comparison

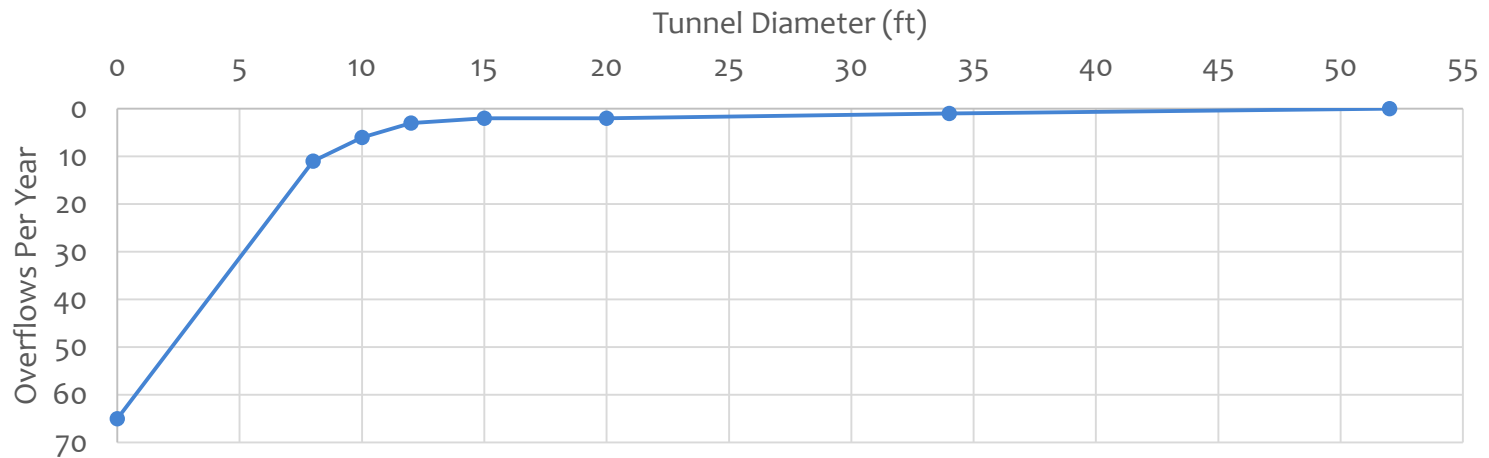
## CSO-003/004 Tunnel Diameter Summary

Tunnel Diameter	1984		2004-2013		20 Year NPW (\$M)
	Number of Overflows	Volume of Overflows (MG)	Number of Overflows*	Volume of Overflows (MG)	
Current Conditions (no tunnel)	67	29.1	65	52.4	-
8-ft	5	2.9	11	27.1	\$69-\$103
10-ft	3	1.1	6	22.7	\$77-\$115
12-ft	0	0	3	19.8	\$85-\$127

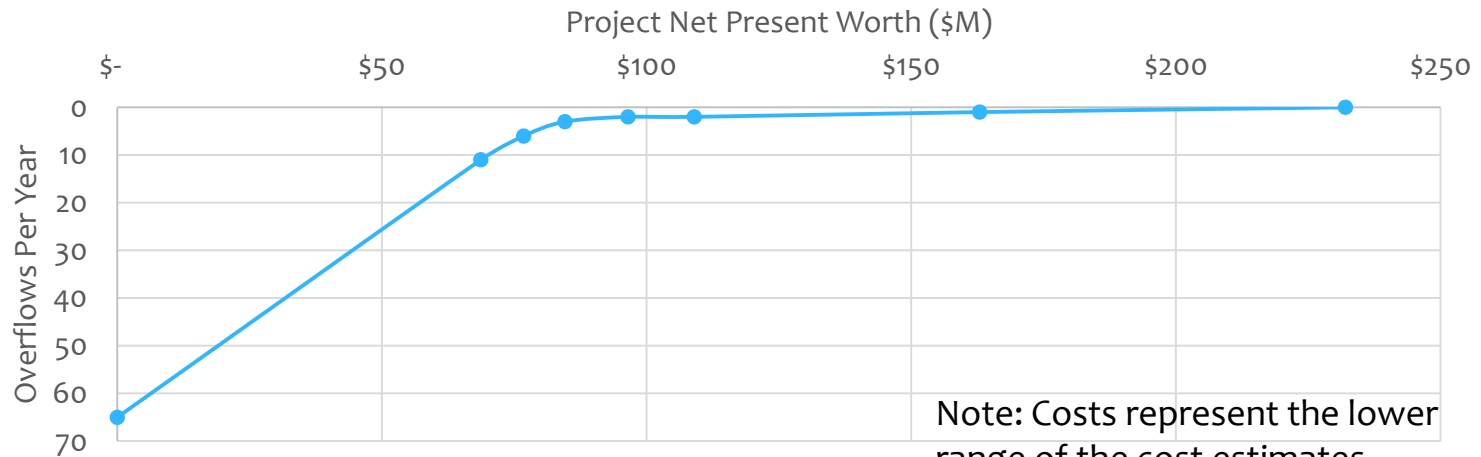
**Note:** In order to eliminate overflows in the recent 10-year period (2004-2013), a 52-ft diameter tunnel would be needed.

# CSO-003/004 Tunnel

## Diameter vs Overflows Per Year (2004-2013)



## Cost vs Overflows Per Year (2004-2013)



Note: Costs represent the lower range of the cost estimates

# CSO-002 Tunnel

## CSO-002 Tunnel Diameter Summary (1984)

Tunnel Diameter	Tunnel Volume (MG)	Number of Overflows	Volume of Overflows (MG)	Overflow Reduction (%)	Flow Capture (%)	NPW (\$M)
Current Conditions (no tunnel)	-	48	35.8	-	58%	-
8-ft	2.0	6	5.7	84%	93%	\$59-\$89
10-ft	3.1	2	2.8	92%	97%	\$67-\$100
12-ft	4.5	1	1.4	96%	98%	\$80-\$120

**Note:** Expected performance estimated for the Typical Year (1984). Actual overflows and volume will be more or less based on specific rainfall events each year.

# CSO-002 Tunnel Comparison

## CSO-002 Tunnel Diameter Summary

Tunnel Diameter	1984		2004-2013		20 Year NPW (\$M)
	Number of Overflows	Volume of Overflows (MG)	Number of Overflows*	Volume of Overflows (MG)	
Current Conditions (no tunnel)	48	35.8	50	67.6	-
8-ft	6	5.7	10	34.8	\$59-\$89
10-ft	2	2.8	7	26.0	\$67-\$100
12-ft	1	1.4	4	20.1	\$80-\$120

**Note:** In order to eliminate overflows in the recent 10-year period (2004-2013), a 38-ft diameter tunnel would be needed.

# Impacts on Overflows - Tanks

## CSO-002 Tank Volume Summary (1984)

Tank Volume (MG)	Number of Overflows	Volume of Overflows (MG)	Overflow Reduction (%)	Flow Capture (%)	NPW (\$M)
Current Conditions (no tank)	48	35.8	-	58%	-
2.0	6	5.7	84%	93%	\$30-\$45
3.0	2	3.1	91%	96%	\$45-\$67
4.0	1	1.9	95%	98%	\$56-\$84

**Note:** Expected performance estimated for the Typical Year (1984). Actual overflows and volume will be more or less based on specific rainfall events each year.

# CSO-002 Tank Comparison

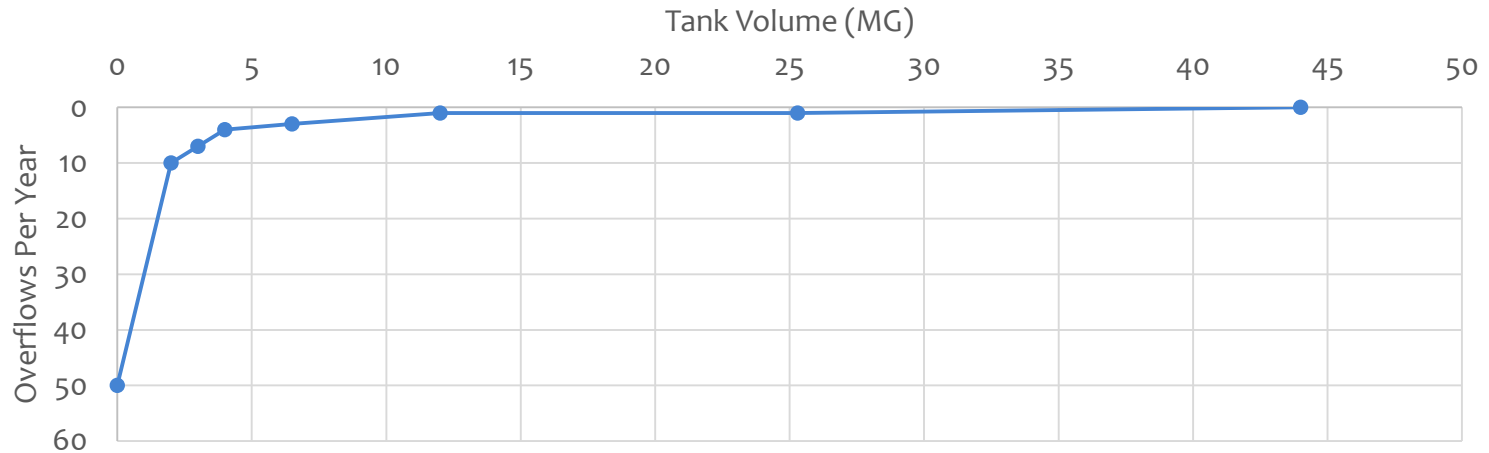
## CSO-002 Tank Volume Summary

Tunnel Volume (MG)	1984		2004-2013		20 Year NPW (\$M)
	Number of Overflows	Volume of Overflows (MG)	Number of Overflows*	Volume of Overflows (MG)	
Current Conditions (no tank)	48	35.8	50	67.6	-
2.0	6	5.7	11	34.8	\$30-\$45
3.0	2	3.1	7	26.8	\$45-\$67
4.0	1	1.9	4	21.8	\$56-\$84

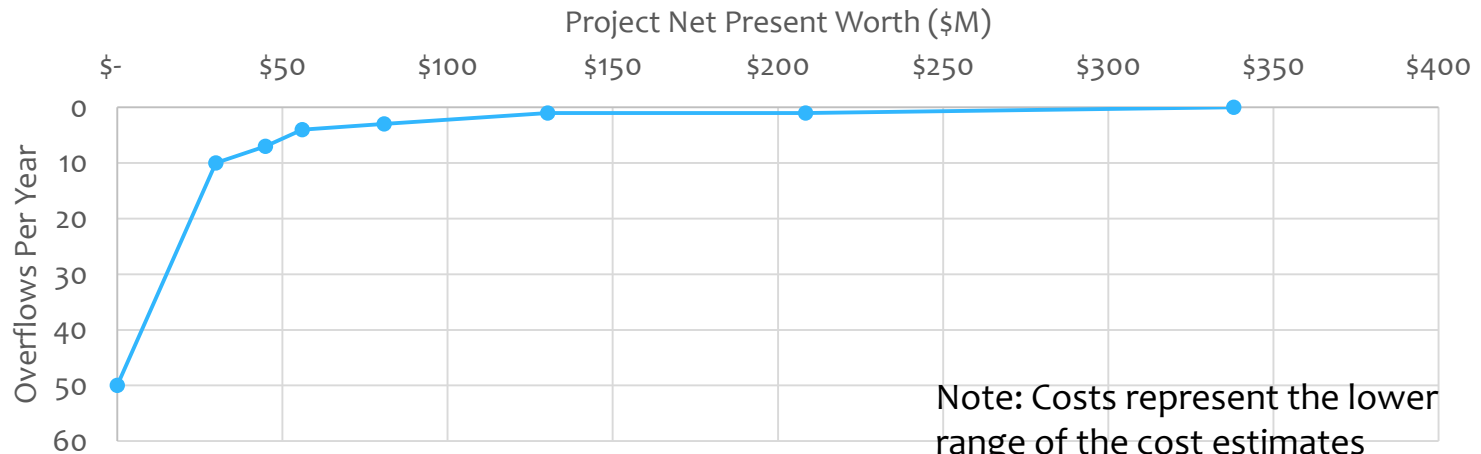
**Note:** In order to eliminate overflows in the recent 10-year period (2004-2013), a 44MG storage tank would be needed.

# CSO-002 Tank

Volume vs Overflows Per Year (2004-2013)



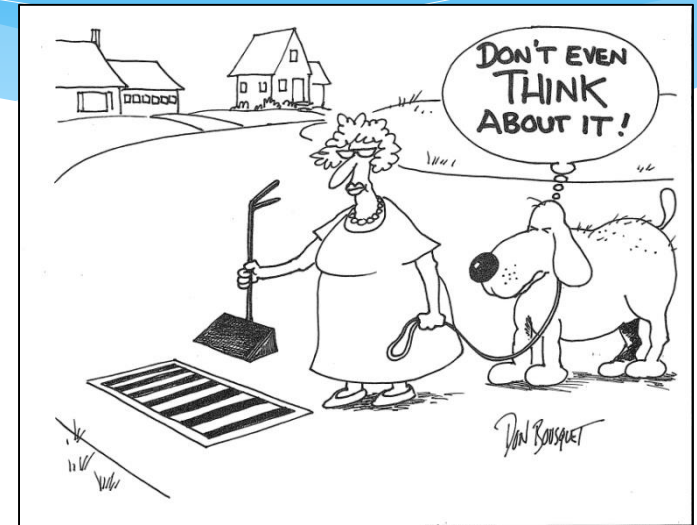
Cost vs Overflows Per Year (2004-2013)



Note: Costs represent the lower range of the cost estimates

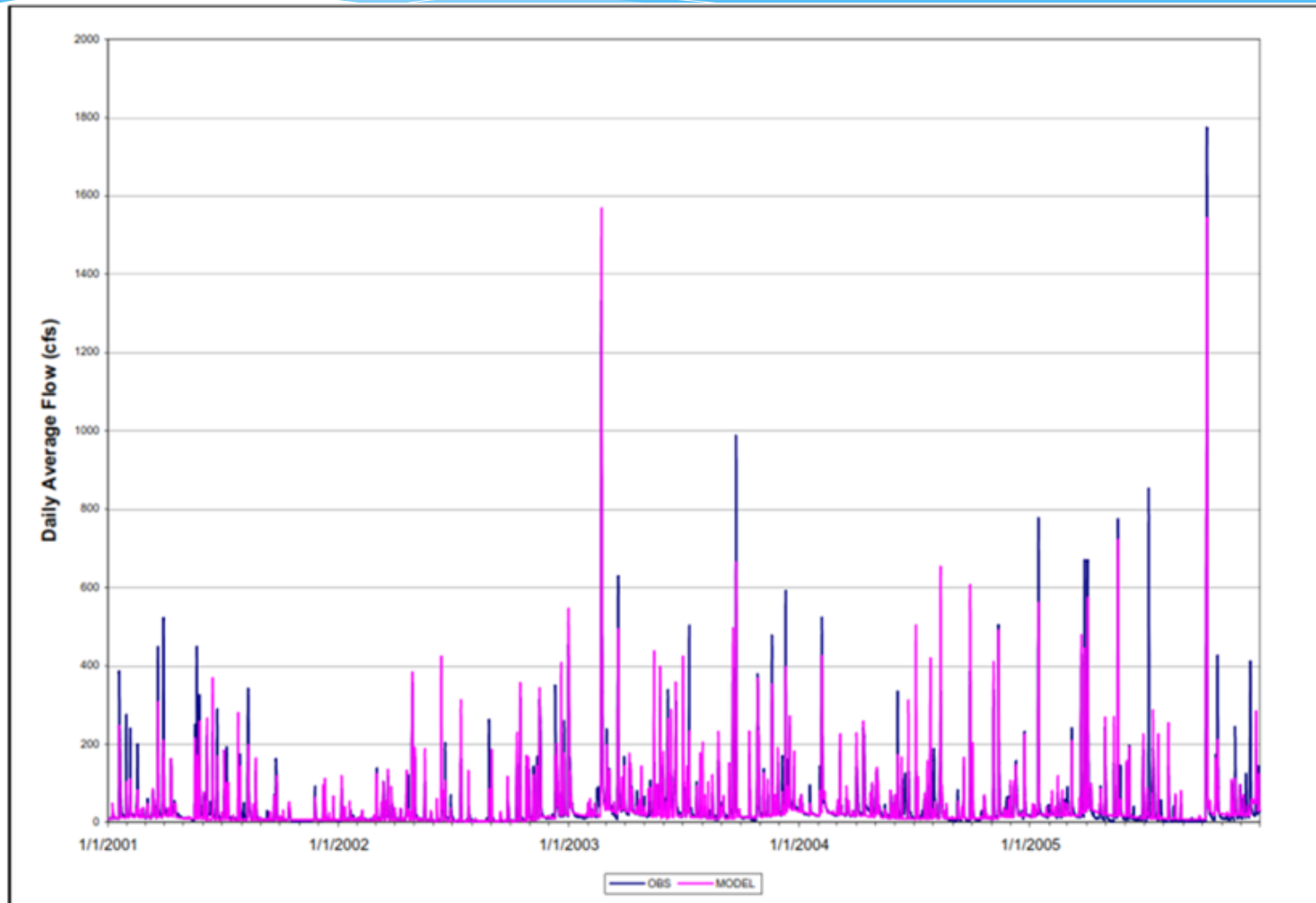
# Water Quality Assumptions

- \* In addition to CSO controls, the TMDL assumes...
  - Removal of 85-98% of the stormwater load (unknown technology)
  - Removal of 100% of the human and septic load
  - Removal of 50% of the wildlife load



# Cameron Run

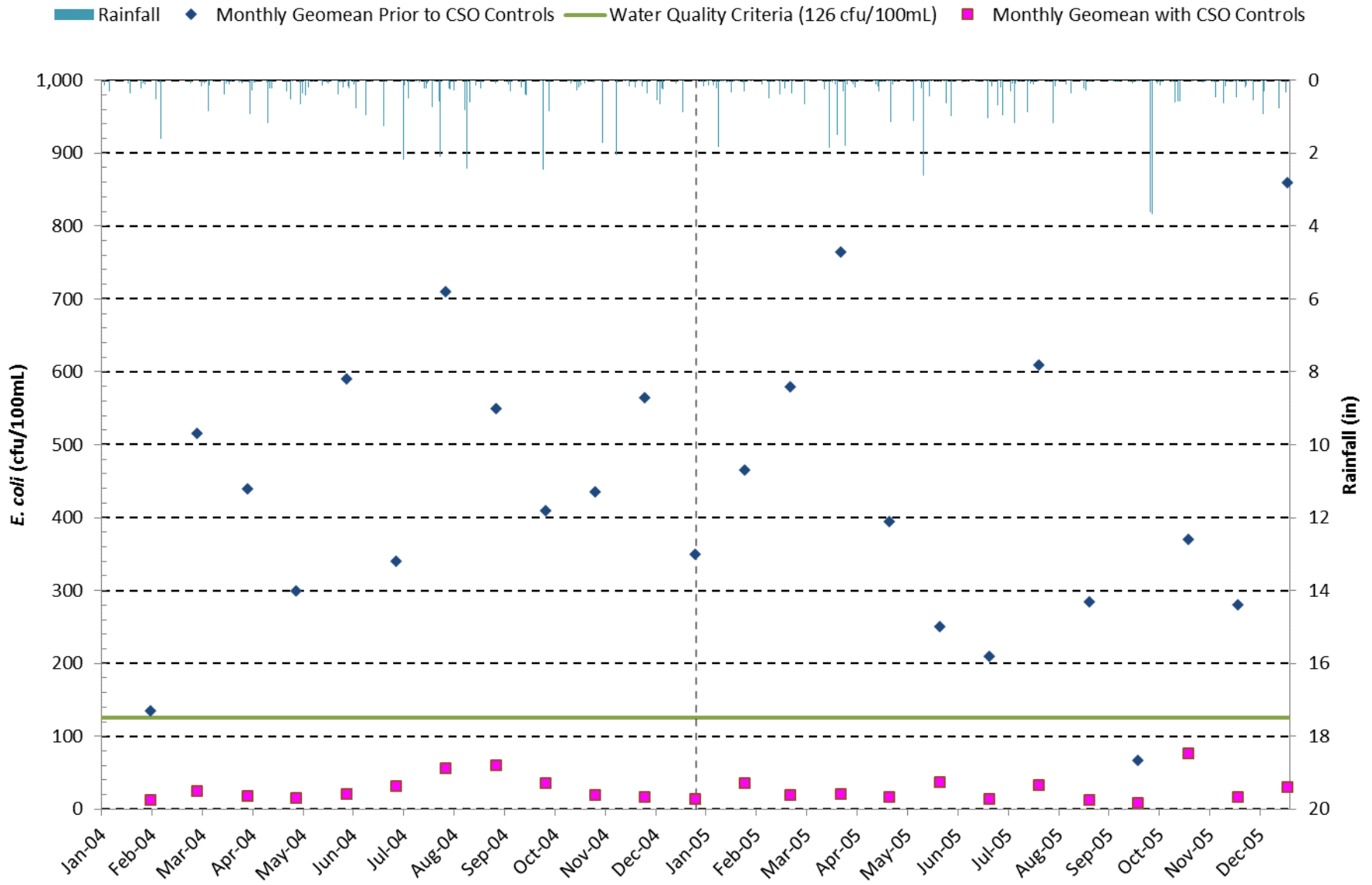
## Simulated and Observed Daily Average Flow 2001-2005



# City WQ Analysis Uses VDEQ Model with some modifications

- \* CSO control eliminates most CSO events and percentage of remaining larger events (discrete)
  - VDEQ used % of each event (proportional)
- \* AlexRenew operating at actual historical effluent concentrations
- \* Upstream Potomac include implementation of the DC LTCP
- \* USEPA DC Water TMDL Bacteria Decay Rate

# Hunting Creek TMDL Criterion

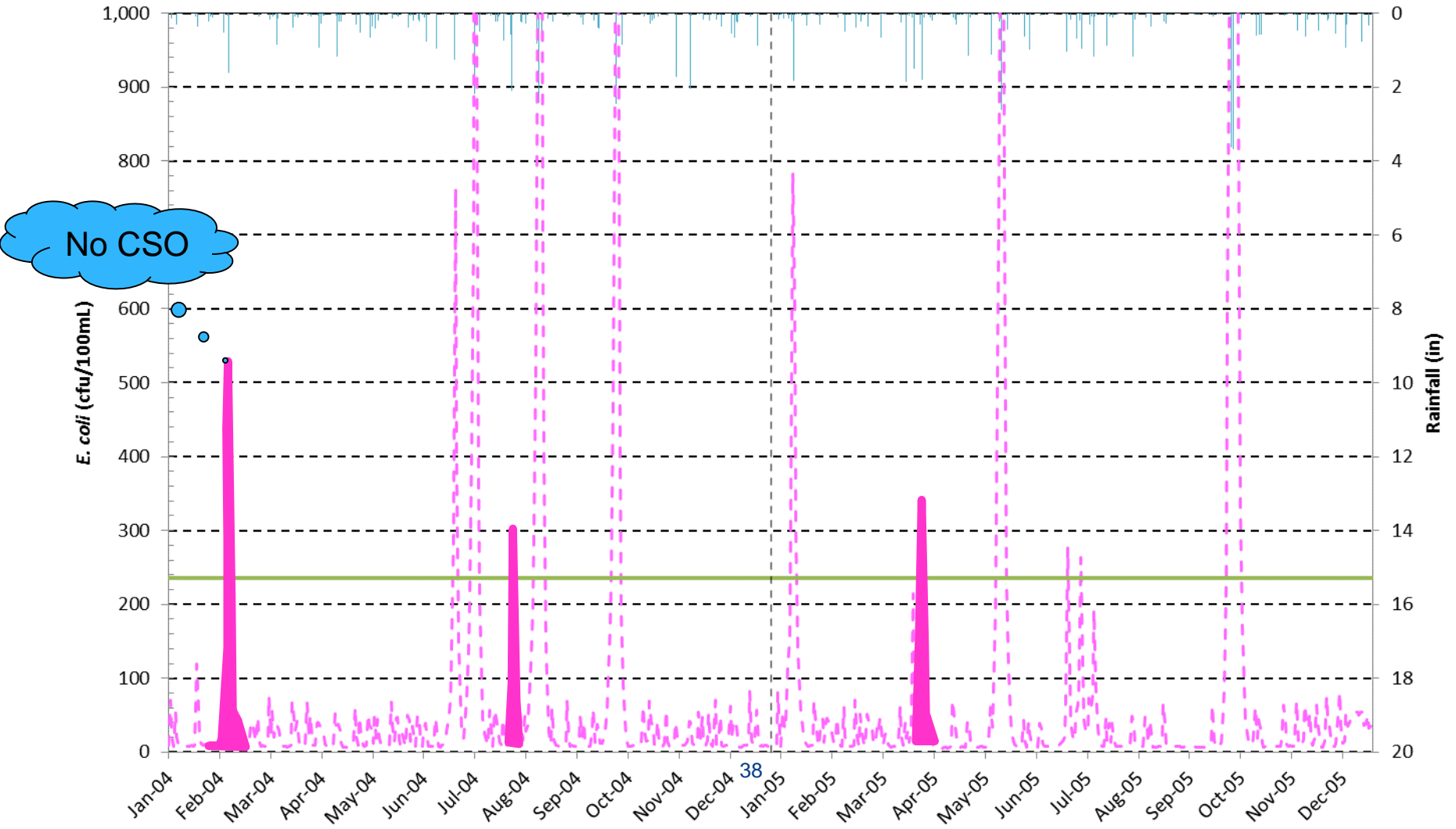


# Recreational Evaluation

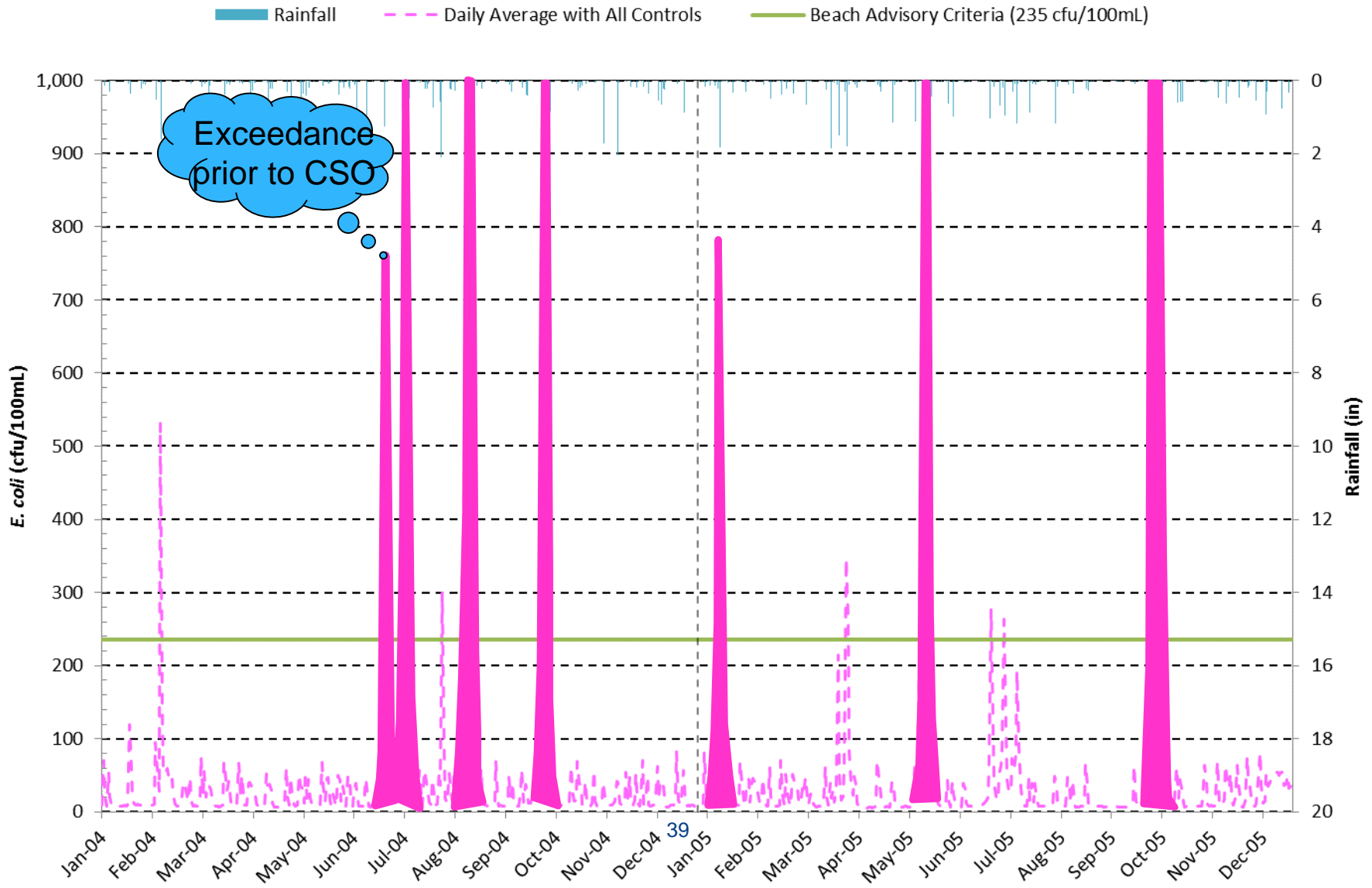
- \* In order to evaluate additional water quality benefits of additional combined sewer controls, the Beach Advisory Level of 235 CFU/100ml was used:
  - Does not represent a water quality standard, but represents the potential recreational benefit
  - This is a number that can be used to advise people of increased risk at a heavily-used beach. We do not have any such beaches.
  - Evaluated by determining how many “beach advisory days” eliminated with larger tanks/tunnels, if we had beaches.

# Beach Advisory Criterion

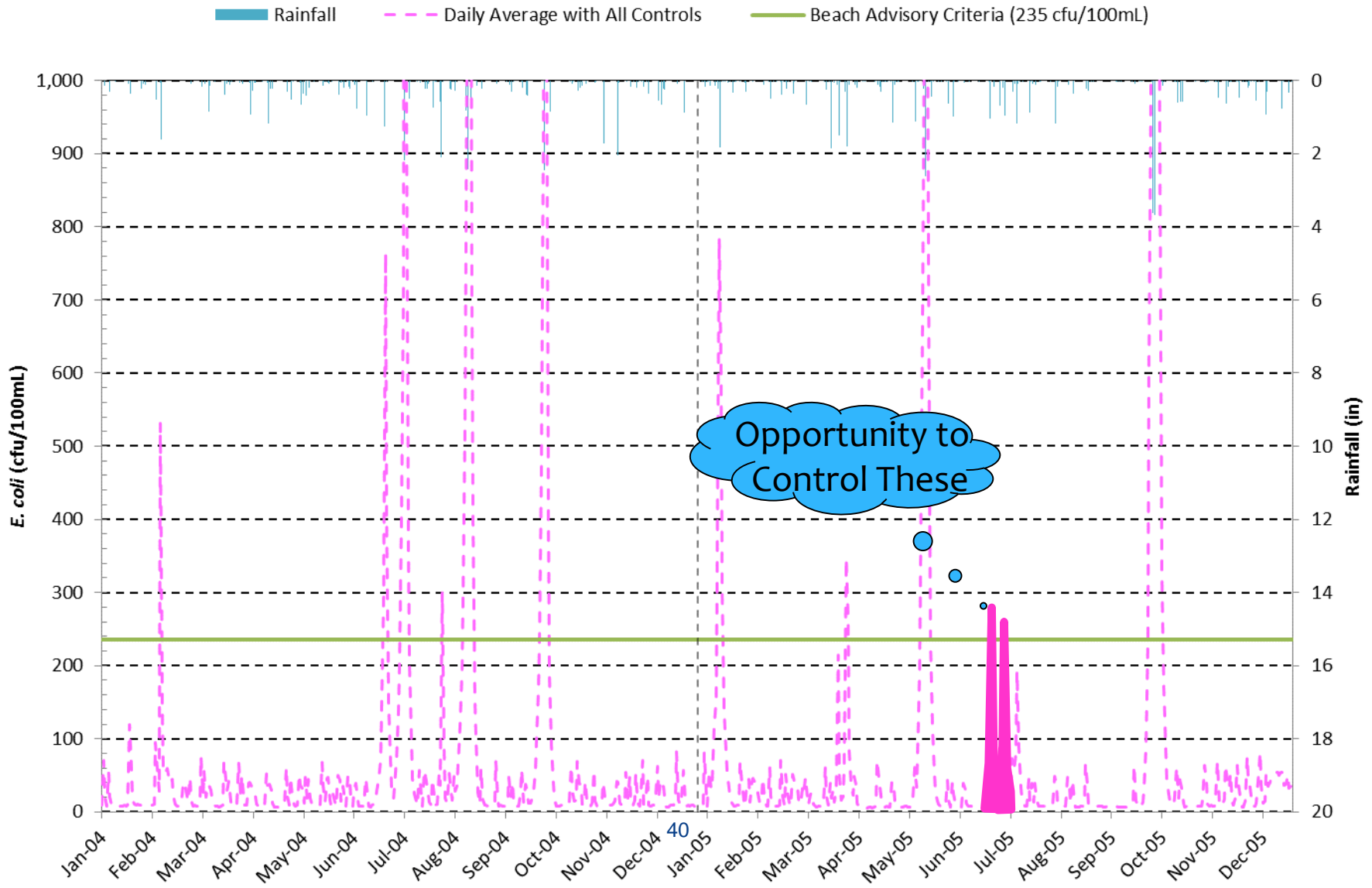
Rainfall      Daily Average with All Controls      Beach Advisory Criteria (235 cfu/100mL)



# Beach Advisory Criterion



# Beach Advisory Criterion



# Observations

- \* Model run with 8-ft diameter tunnel for CSO-003/004 and 2MG tank for CSO-002
- \* One event 1.60" of rainfall and no overflow
  - Assume any event larger would cause exceedance without CSOs
  - 3 events
- \* Several events exceed days prior to CSO
  - 7 events
- \* Some events were driven entirely by CSO
  - 2 events
  - *E. coli* peak at 277 cfu/100mL
  - 15% reduction in CSO volume should yield 15% reduction in *E. coli* (277 -> 235)
- \* Upsizing storage could eliminate 2 of 12 beach advisory events

# Beach Advisory Events

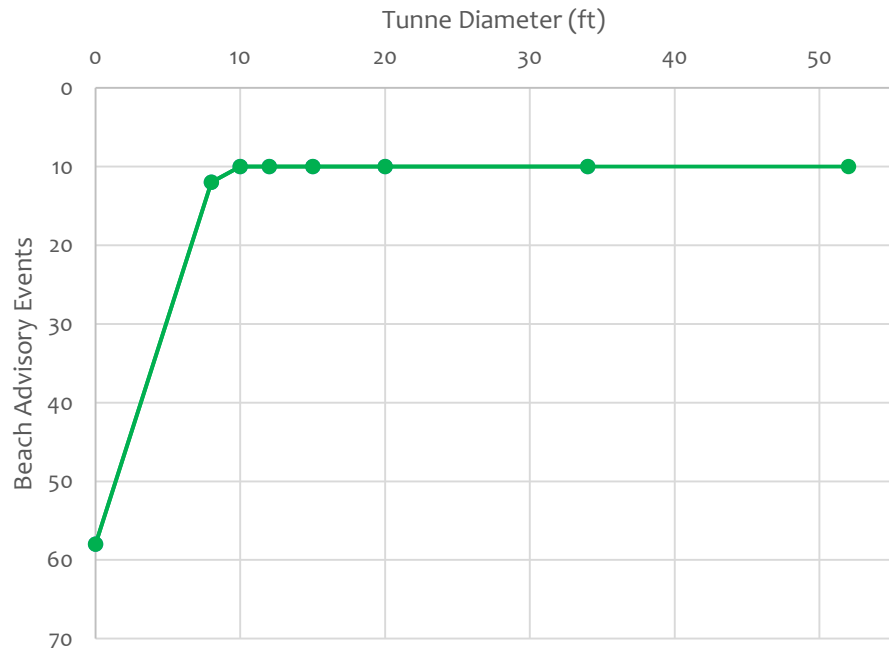
003/004 Tunnel Diameter	Beach Advisory Events (2004-2005) <sup>1</sup>	002 Tank (MG)	Beach Advisory Events (2004-2005) <sup>1</sup>
Current Conditions (no tunnel) <sup>2</sup>	58	Current Conditions (no tank) <sup>2</sup>	58
8-foot	12	2.0	12
10-foot	10	3.0	10
12-foot	10	4.0	10
52-foot	10	44.0	10

**Notes:**

1. Expected performance estimated for the years indicated. Actual performance may be more or less based on specific rainfall events each year.
2. 58 beach advisory events are based on upstream conditions in Cameron Run.

# Water Recreational Benefits

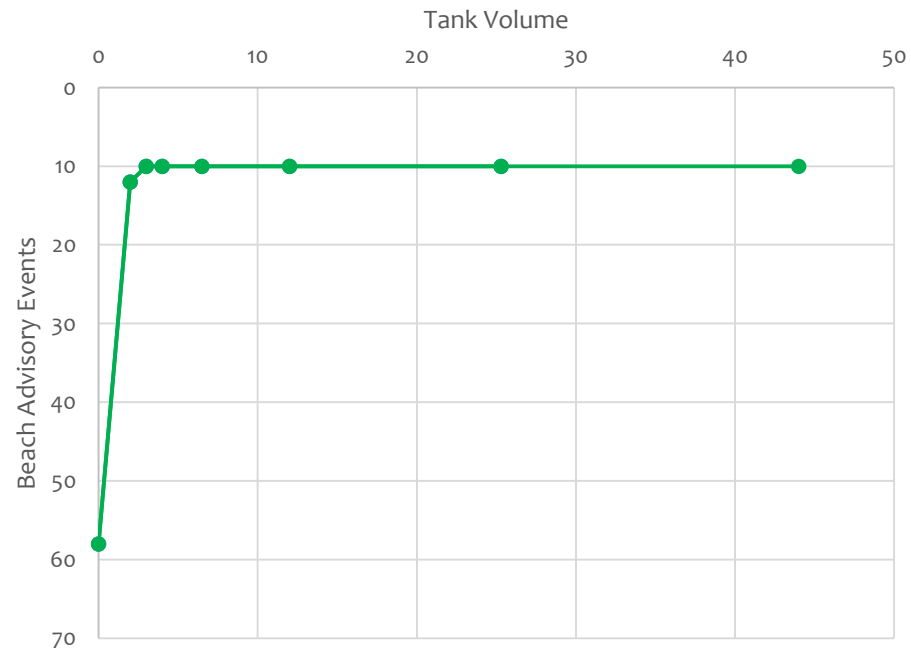
Diameter vs Beach Advisory Events



CSO-003/004 Tunnel

CSO-002 Tank

Volume vs Beach Advisory Events



# Sizing Conclusions

- \* All sizing alternatives meet the regulatory requirements
  - 8-foot tunnel (003/004) or 2 MG tank (002) meets the presumptive approach requirements
- \* Bigger gray infrastructure will:
  - Reduce the number of overflows and total overflow volume
  - Accommodate uncertainty of future weather patterns
  - Provide little discernable water quality benefit
  - Cost more to construct, operate, and maintain
  - Increase disruption during construction
- \* Bigger gray infrastructure will not:
  - Address the other sources of bacteria (e.g. stormwater, wildlife, pets)
  - Provide other ancillary benefits

# Caveats on Sizing Conclusions

- \* Uncontrollable non-CSO loads prevent actual reduction in “beach advisory” events
- \* Some stakeholders conclude the smaller facilities provide adequate control and some want the higher control provided by larger facilities
- \* The ultimate decision will be up to the City Council

# Staff's Preliminary Sizing Recommendation

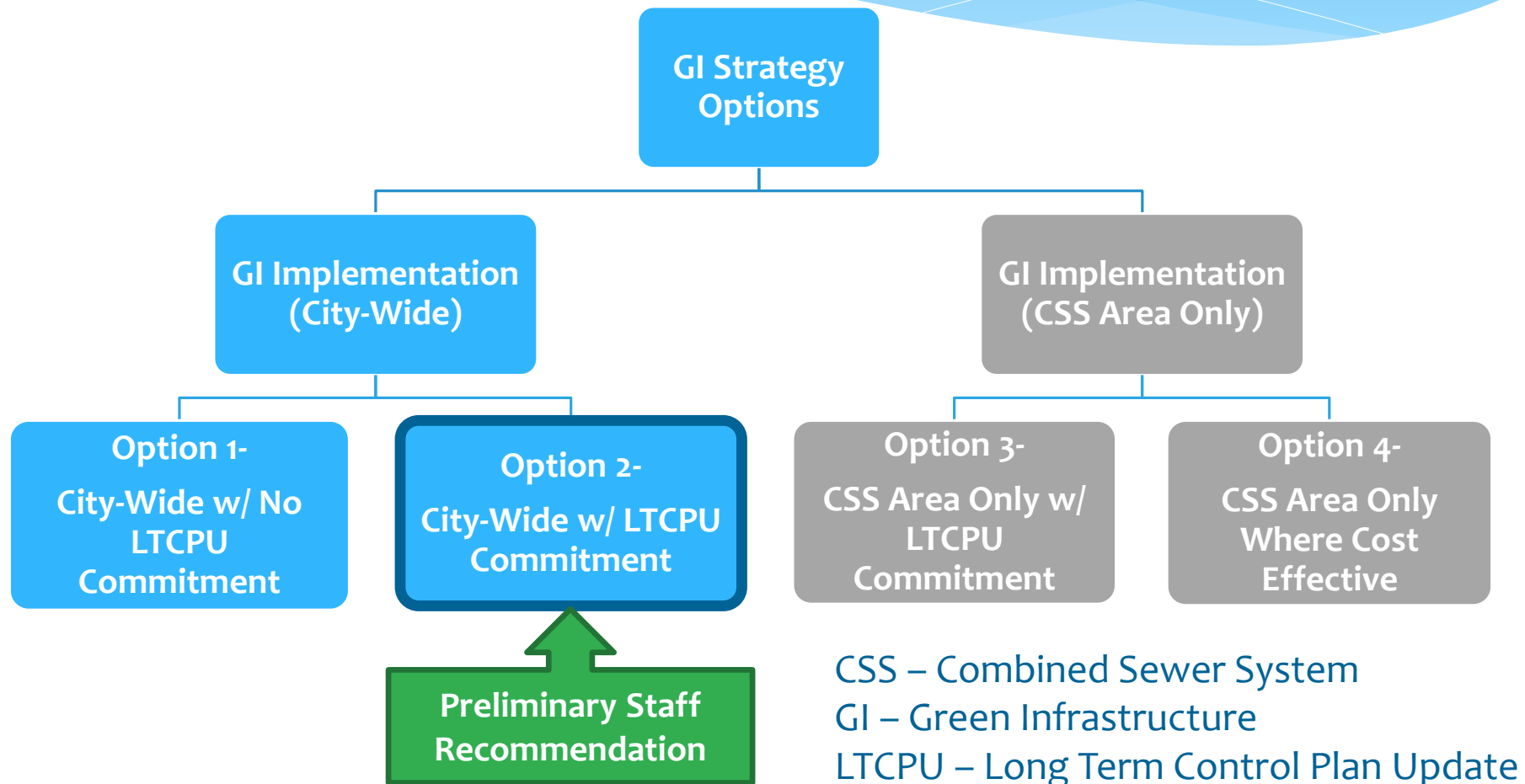
- \* 10-foot Diameter Tunnel and 3.0 million gallon Tank
  - More than the minimum
  - Helps to mitigate regulatory uncertainty
  - Helps to mitigate climate change
  - Less than 4 overflows per year during the typical year (1984)
- \* CSO-003/004
  - 10-ft tunnel has 6 overflows per year for recent climate period
- \* CSO-002
  - Tunnel/Tank: 7 overflows per year for recent climate period as opposed to 10 with the smaller size
- \* Above recommendations were generally supported by the CSS Stakeholder Group

City of Alexandria, Virginia

# Green Infrastructure Strategy



# Green Infrastructure Strategy Options



# Green Infrastructure Strategy

## Preliminary Recommendation

- \* Continue to implement existing green infrastructure pilot permit for current permit cycle (2013-2018)
- \* For next permit cycle (2018-2023), expand upon existing green infrastructure program by:
  - Add funding in 10-year Capital Improvement Program and implement variety of green infrastructure practices
  - Evaluate incentive programs for private property
  - Evaluate increasing number of street trees (tree canopy) in CSS
- \* Assess effectiveness of different practices compared to cost of implementation and neighborhood impacts
- \* Based on assessment, consider establishing program and target goals for future permit cycles

# Preliminary Staff Recommendation

## Green Infrastructure Target Goals (2018-2023)

- \* **Cost Discussion with Stakeholders**
  - \$1-2 M of the LTCPU costs in City-led green infrastructure projects both in the combined sewer area and outside of it
- \* **Returns on Green Investment to Be Assessed**
  - Stormwater volume reduction
  - Impervious area treated
  - Nutrient credits
  - Number of trees planted and tree canopy
  - Community benefits
- \* **Types of Projects**
  - Green alleys, bioretention, trees (boxes), stream restoration, pond retrofits, etc.

City of Alexandria, Virginia

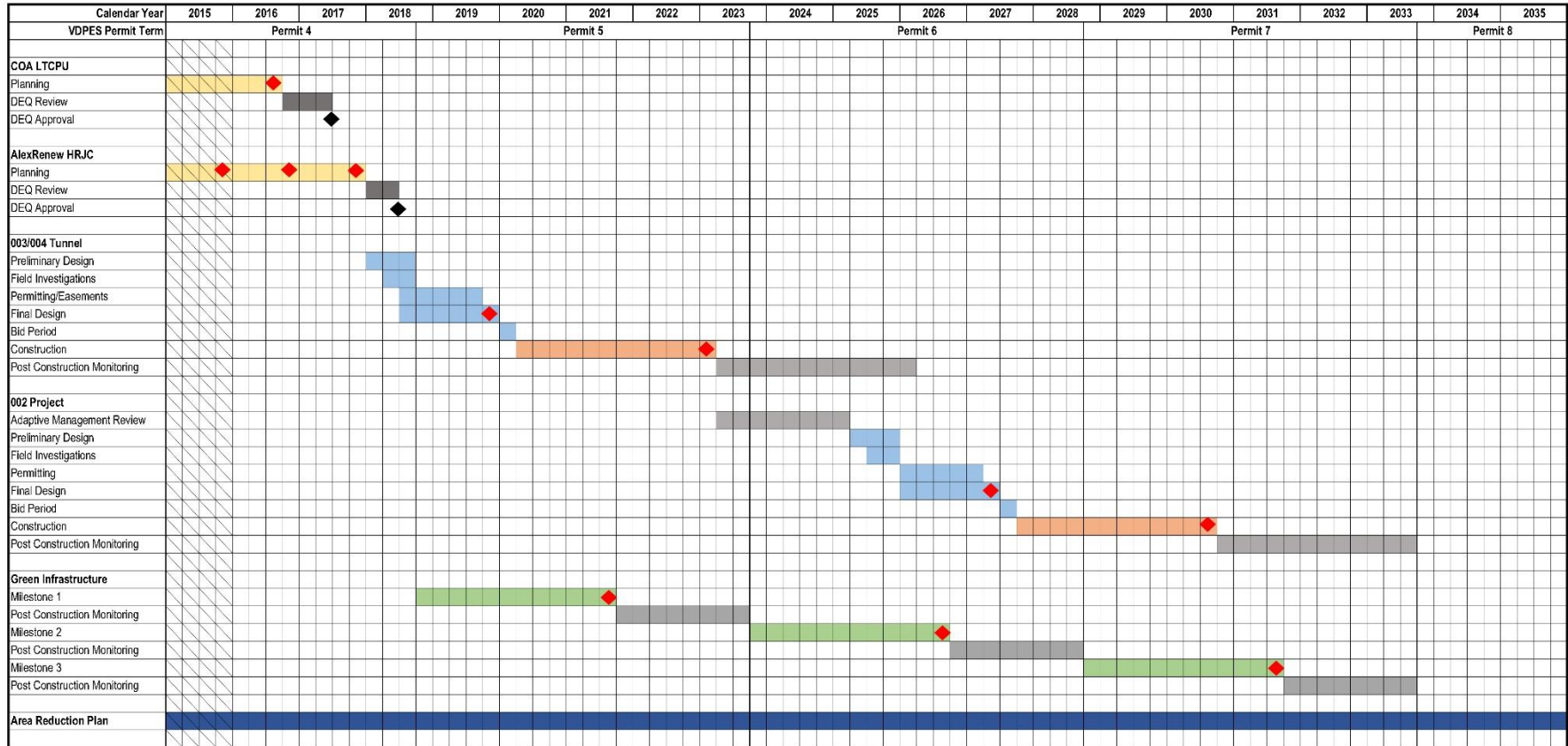
# Implementation



# Conceptual Implementation Plan

## City of Alexandria: Long Term Control Plan Update Preliminary Implementation Schedule

Last Update: February 17, 2016



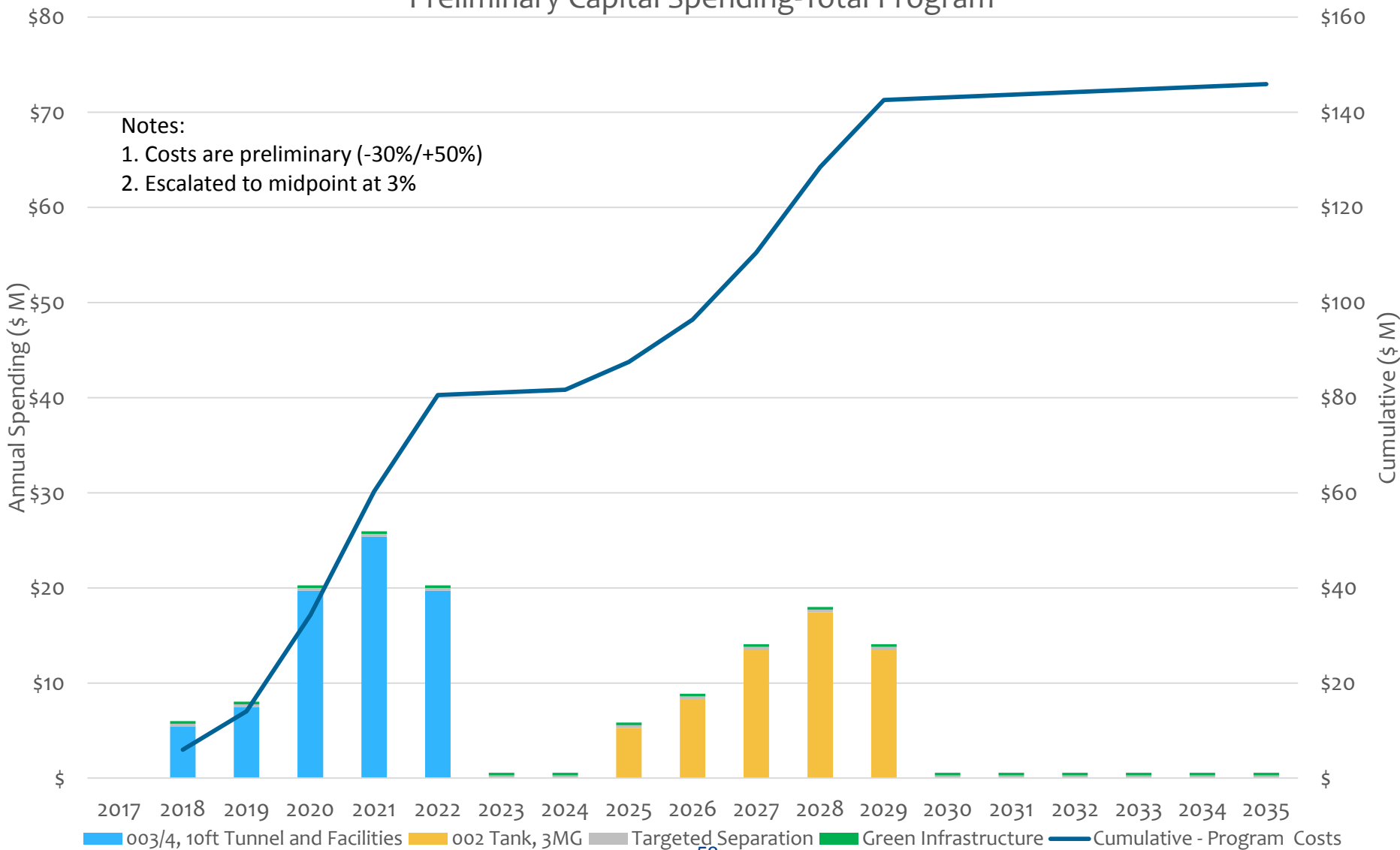
### Legend

- ◆ Regulatory Approval
- ◆ Potential Permit Milestone
- Planning Activity
- Regulatory Review
- Design Activity
- Construction Activity
- Post Construction Monitoring
- Green Infrastructure
- Intermittent Separation Projects

# City of Alexandria, LTCPU Preliminary Capital Spending-Total Program

## Notes:

1. Costs are preliminary (-30%/+50%)
2. Escalated to midpoint at 3%



# Upcoming Outreach

## \* February 2016

- AlexRenew Board Meeting

## \* March 2016

- CSS Stakeholder Meeting #5
- Federation of Civic Associations

## \* April 2016

- CSS Stakeholder Meeting #6
- Public Meeting
- Old Town Civic Association
- West Old Town Citizens Association
- Waterfront Commission
- NOTICE Board Meeting
- Environmental Policy Commission
- City Council Worksession

## \* May 2016

- City Council Public Hearing

City of Alexandria, Virginia

# Questions

